



PUTTING RESEARCH TO WORK

BRIEF

Emergency Bridge Repairs: Learning from the Past

With more than 18,000 bridges in Wisconsin, WisDOT engineers must be prepared to respond quickly in emergency situations to ensure the continued safe flow of goods and travelers. Bridge incidents requiring response could include vehicle impacts, flooding, tornadoes and extreme temperatures. Bridge maintenance professionals need appropriate tools and knowledge to address every situation.

What's the Problem?

WisDOT bridge engineers recognized the need to develop an effective decision support system to help them evaluate structural incidents and formulate an effective response for each situation—for example, whether to close the bridge, and what types of repairs are needed, if any. An effective system would draw from a database of Wisconsin bridges that incorporates information such as previous history; current condition of the structure; local police, fire and medical information; traffic type and level; and available service groups such as contractors and consultants.

This database would form a knowledge base of previous experiences in which emergency responses were required. This “library of expertise” would become the foundation for future decisions and actions under similar conditions.

Research Objectives

As a first step in improving the long-term preparedness of Wisconsin bridge maintenance officials, this research project sought to develop an easy-to-use, widely accessible database of bridge case histories to assist bridge engineers and inspectors in evaluating structural incidents and formulating effective responses. This data could then be used and expanded in a future study to develop a decision support system.

Methodology

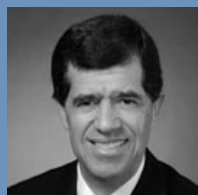
Sixteen bridges were selected for the database to exemplify a wide range of factors: geographic and structural diversity, as well as varying degrees of repair challenges. The set includes both concrete and steel bridges and at least one structure from each of the five WisDOT regions. The failures involved sudden impacts, fire, scour, fatigue cracking and material deterioration. The bridges chosen for this study were located over waterways as well as highways.

Case history information for bridges included in the database was assembled using archived data from various WisDOT offices and through detailed interviews. The researchers interviewed active and retired bridge maintenance engineers, inspectors and supervisors in each WisDOT regional office, the cities of Milwaukee and Madison, as well as WisDOT's Traffic Operations Center in Milwaukee. The department's Highway Structures Information System also provided a significant amount of information.

Results

As a result of this research, WisDOT bridge engineers, inspectors and maintenance professionals now have access to a new tool: the Bridge Incident Response Database. BIRD is a searchable, Web-based resource that includes 16 case histories of emergency response bridge repairs. The selected cases include the most common damage and failure types within the state. General users can easily search for relevant case histories using keywords, and users with administrative privileges can add to the database or edit current entries.

Investigator



“Knowledge gained by bridge maintenance professionals over time can now be quickly accessed in emergency situations.”

—Al Ghorbanpoor,
Ph.D., P.E.

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“BIRD is another valuable tool our bridge inspectors can use when evaluating bridge damage in the field. Having historical data on prior incidents at the engineers’ fingertips will be invaluable when time is critical to repairing or securing the structure.”

— Edward Fitzgerald, P.E.

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Construction crews repair girders damaged by vehicle impact on westbound I-94 in Eau Claire. With BIRD, maintenance professionals can respond quickly and effectively to urgent situations.

Additional outputs of this project include a detailed literature review of state-of-the-art decision support systems for bridge repair, manuals for both system administrators and users on installation and use of the database, and incident response procedures for WisDOT and the city of Milwaukee.

Implementation and Benefits

BIRD offers Wisconsin bridge maintenance professionals a promising new resource for responding to bridge emergencies and repair challenges. To fully utilize the results of this study, the research team recommended that WisDOT:

- Develop essential elements of an appropriate decision support system that is based on the case histories and other relevant elements (such as procedures for emergency response repairs).
- Train department staff in all regions on the use of the database and the decision support system (using the manuals developed in this project).
- Maintain a permanent server and Web site for the database and the decision support system.
- Populate and update the database with new case histories or incidents as they occur.

Further Research

Phase II of this study (see the project page at http://www.whrp.org/Research/Structures/struct_0092-04-15/index.htm) will expand the case history database, adding at least 10 Wisconsin bridges representing a variety of bridge types and materials and common damage and failure mechanisms. If appropriate, an additional five to 10 structures from other states may be included in the database as well.

The expanded database will include an interactive question-and-answer feature that can recommend actions based on similar situations in the past. The system will be designed so that additional case histories can be added easily to improve the quality of the recommendations.

The department’s long-term goal is to build upon these tools to create a Web-based decision support system that can be used by engineers across the state.

This brief summarizes Project 0092-04-15, “Bridge Integrated Analysis and Decision Support: Case Histories,” produced through the Wisconsin Highway Research Program for the Wisconsin Department of Transportation Research Program, 4802 Sheboygan Ave., Madison, WI 53707.

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